Detergent Experiments on Cotton

Evaluation of Washing Media for Goods Soiled with Oiled Lamp Black

BY ROBERT M. CHAPIN *

FOLLOWING detergent experiments on cotton soiled with non-oily carbon black,[1] similar work has been done on cotton soiled with oiled lamp black. The latter substance was chosen because it was more finely divided than the carbon black at hand, the fact that it was originally oily making no difference in this case.

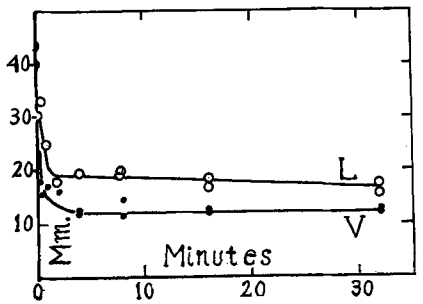

Figure 1.—*Effect of Duration of Washing in Experiment* 1 *on Soil Compounded with Lard (Curve L) and with Vaseline (Curve V).*

New cotton poplin (Burton's Irish Poplin) was given a preliminary washing as before, but this time the material was cut perpendicularly to the selvage into strips three-fourths inch wide and was not ether-extracted before soiling.

The soil was applied in ointment form, that is, as a paste stiff enough not to flatten on standing, made by thoroughly incorporating sufficient lamp black into the chosen vehicle. A 9-inch strip of the goods was laid on plate glass and completely covered with ointment, liberally smeared on with a spatula, then most of the excess was scraped off with a firm pressure on the tilted spatula blade. Next the strip was turned over and treated in the same way on the other side. The glass plate was kept fairly clean by scraping with the spatula. After a sufficient number of strips had been thus treated the plate and spatula were thoroughly cleaned with paper towelling and kept clean thereafter while the strips were again scraped on both sides

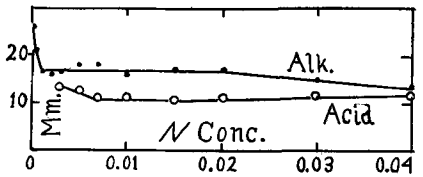

Figure 2.—*Alkaline and Acid Sodium Palmitate at* 65° *C. against Vaselined Soil in Experiment* 2.

to remove excess ointment, either directly by the spatula or by adherence to the glass plate. Next, each was drawn once or twice from each end through a firmly held fold of clean paper towelling. Finally they were laid smoothly on a sheet of glass, left in an oven at 100°C. for one-half hour and then kept at room temperature for at least one hour before use.

Heated Sufficiently

The washing was conducted in the same machine and manner as

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[1] O. & F. Ind. 5 95 (1928). In that paper as printed the cuts for Figures 7 and 8 should be reversed.

previously described, except that the soap solutions were heated only sufficiently to insure complete solution and mixing, and were left in the bath for only three-fourths hour before use. The soiled strips, after rejection of one-half inch at each end, were cut into 2-inch lengths. Each resulting slip was provided with a lead weight and inserted into a clip of the machine. After washing, the residual stain

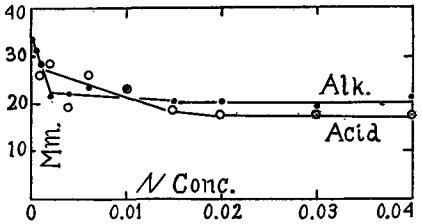

Figure 3.—Alkaline and Acid Sodium Palmitate at 65° C. against Larded Soil in Experiment 2.

was compared in the same colorimeter and against the identical standard used in the work on carbon black.

To insure a soil that would surely remain uniform the first preparations employed a greasy vehicle, either yellow vaseline or high-grade lard. In a stout 150 cc. beaker provided with a thick glass rod, ten grams of the black were thoroughly mixed with fifty grams of the vehicle by alternate periods of heating in an oven at 100°C. and stirring when cool enough to handle. When a perfectly smooth paste had been obtained the beaker was set in cold water and the contents were continually stirred until well stiffened, after which a spatula was employed. The finished ointment was left at least one hour at room temperature before use and was always freshly worked with the spatula before application.

Experiment 1.—The first experiment dealt with the effect of duration of washing at 75°C. in 0.03

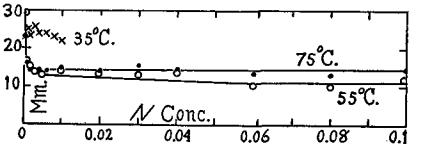

Figure 4.—Neutral Sodium Palmitate against Vaselined Soil at Various Temperatures in Experiment 3.

N neutral sodium palmitate, with a 4-minute rinse in distilled water. The results are given in Figure 1. For all subsequent experiments the wash period was eight minutes and the rinse four minutes.

Experiment 2.—The relative powers of alkaline and acid sodium palmitate at 65°C. were compared, with the results shown in Figure 2 for vaselined black and in Figure 3 for larded black.

Experiment 3.—The effect of variation of temperature upon the power of neutral sodium palmitate upon vaselined black is shown in Figure 4.

Experiment 4.—Results upon vaselined black with neutral sodium laurate at 75°C. and with neutral sodium oleate at 35°C. are given in Figure 5.

The larded black usually was more resistant than the vaselined. Both however, were more powerfully removed by acid soaps than by alkaline ones. The writer[1] has noted a similar order in the powers of acid and alkaline soaps to emulsify oils and to deflocculate oily black, an order the reverse of that of their powers to deflocculate naked carbon black and to cleanse goods soiled with that substance.

Properly to compare soaps at different temperatures it seemed

[1] O. & F. Ind., 4 15 (1927).

necessary to use in the soil a vehicle which should be of nearly uniform consistency throughout the temperature range. Hence a soil was

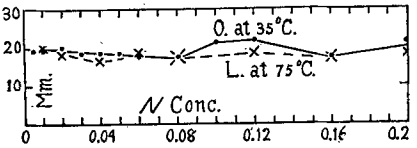

Figure 5.—Neutral Sodium Laurate at 75° C. (Curve L) and Neutral Sodium Oleate at 35° C. (Curve O) against Vaselined Soil in Experiment 4.

compounded from lamp black, fifteen grams, and laxative mineral oil, fifty grams, in a manner similar to the preceding except that heating seemed unnecessary. Though it formed a softer paste it did not flatten on standing.

Experiments 5 to 8.—Results with various neutral sodium soaps at 20, 40, 60 and 80° C. are given in Figures 6 to 9. Stoppage of a curve short of the limit of 0.2 Normal indicates that the next higher

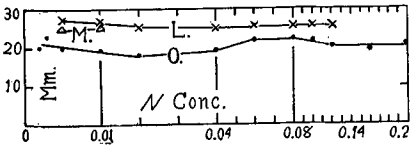

Figure 6.—Neutral Sodium Laurate (Curve L), Myristate (Curve M) and Oleate (Curve O) against Oiled Soil at 20° C. in Experiment 5.

concentration tried proved too thickly laden with crystals to be workable. These experiments well bring out the importance of selecting soap appropriate for the particular temperature at which the washing is to be conducted. Sodium oleate was unrivalled up to 40° C. At 60° C. palmitate slightly surpassed oleate and took first place, that temperature being a little too low for stearate to function successfully. At 80° C. stearate became decidedly the superior.

These detergent tests were obviously less sensitive to changes in the temperature and composition of the soap solutions than were the emulsification tests previously described. Also, ocular evidence of this dissimilarity frequently appeared during the work. In certain runs on some soaps it was noticed that different concentrations showed conspicuous differences in the degree of dispersion of the oily black in the residual solutions and in the cleanliness of the brass clips

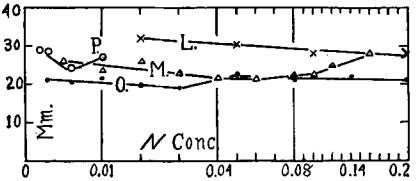

Figure 7.—Neutral Sodium Laurate (Curve L), Myristate (Curve M), Oleate (Curve O) and Palmitate (Curve P) against Oiled Soil at 40° C. in Experiment 6.

on removal, without such differences being more than faintly, if at all, reflected in the relative cleanliness of the slips. The acid soaps, of course, effected a finer dispersion of the soil and left the clips much cleaner than did the corresponding alkaline soaps.

For comparison with the results of the straight washing experiments some special trials were made of other methods.

Experiment 9.—Inasmuch as neutral gelatin had shown[1] notable deflocculating power against oiled carbon black, the detergent power of a six per cent solution at 55° C.

[1] Ind. & Eng. Chem., 19, 1275 (1927).

was tested upon vaselined black with the results shown in Table 1. It was therefore decidedly inferior to sodium palmitate at that temperature.

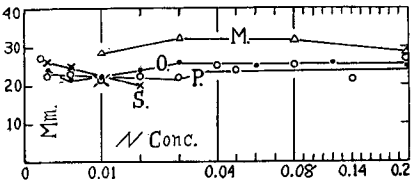

Figure 8.—*Neutral Sodium Myristate* (*Curve* M), *Oleate* (*Curve O*), *Palmitate* (*Curve P*) *and Stearate* (*Curve S*) *against Oiled Soil at* 60° *C. in Experiment* 7.

Experiment 10.—It seemed worth while to test the effect of adding a fat-solvent to soap solutions in the low-temperature washing of greasy stains. Tubes of 0.1 Normal sodium oleate were left in the bath at 35° C. for one-half hour. Then one cc. of a fat-solvent was added, the stoppered tubes were vigorously shaken one minute, and then returned to the bath for one-half hour before the wash was started. The results are also given in Table 1.

Experiment 11.—For comparison with the results of Experiment 10 it seemed necessary to run some tests with solvents alone, without soap solution. These were done at room temperature, about 26° C. The wash period was eight minutes and the rinse four minutes, with thirty cc. of solvent in each tube. The results are also given in Table 1.

Experiment 12.—Dry-cleaning soap[1] was prepared from sodium hydroxide and excess oleic acid and 0.2 per cent of it was added to petroleum ether for the washing medium, but none in the rinse. The results are given in Table 1.

[1] Bureau of Standards Technologic Paper No. 322.

Sew Slips

Experiment 13.—Soiled slips were sewed to white duck pants as in the detergent experiments on goods soiled with carbon black and these were sent to the power laundry as usual. The results are given in Table 1.

The most powerful washing effect in the laboratory was accordingly obtained when sufficient of an appropriate fat-solvent was added to aqueous soap.

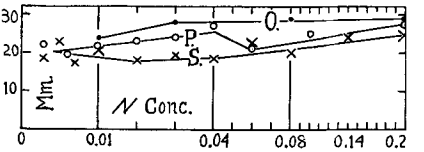

Figure 9.—*Neutral Sodium Oleate* (*Curve O*), *Palmitate* (*Curve P*) *and Stearate* (*Curve S*) *against Oiled Soil at* 80° *C. in Experiment* 8.

Summary

Cotton fabric was soiled with an ointment of lamp black and vaseline, lard, or medicinal mineral oil. After washing in a special machine, the residual soil was evaluated by a colorimeter used as a reflectometer.

Of pure sodium laurate, myristate, palmitate, stearate and oleate, the latter was the most powerful up to 40° C., while palmitate took first place at 60° C. and stearate at 80° C. Addition of sufficient appropriate fat-solvent enhanced detergent power.

In parallel with the writer's findings on emulsification, excess fatty acid enhanced detergent power while excess alkali decreased it. Other resemblances between emulsification and detergency were not distinct.

TABLE 1
Results of Experiments 9 to 13

Experiment	Vehicle of Soil	Washing Medium	Colorimeter Readings[1]	
9	Vaseline	Neutral gelatin solution.....	21.0	
			23.5	22.0
10 (a)	Vaseline	Neutral oleate, alone.....		21.5
10 (b)	Vaseline	Oleate plus cresol, U. S. P.	19.5	18.5
			17.5	
10 (c)	Vaseline	Oleate plus carbon tetrachloride.....	9.0	
			7.5	8.5
10 (d)	Lard	Neutral oleate, alone.....	17.0	
			17.0	17.0
10 (e)	Lard	Oleate plus carbon tetrachloride....	12.0	
			12.0	12.0
11 (a)	Vaseline	Carbon tetrachloride, alone.....	24.0	
			21.0	22.5
11 (b)	Vaseline	Petroleum ether, alone.....	26.5	
			23.5	24.5
12	Vaseline	Petroleum ether plus dry-cleaning soap	23	
			19	21.0
13 (a)	Vaseline	Power laundry[2]		10
13 (b)	Lard	Power laundry[2]		14.5
13 (c)	Oil	Power laundry[2]		18.5

[1] Each pair of readings in the first column represent duplicate slips, not merely the two sides of a single slip.
[2] Sent on different dates.

Value of Linseed Production Decreases 20.8 Per Cent

The Department of Commerce announces that, according to data collected at the biennial census of manufacturers taken in 1928, the establishments engaged primarily in the manufacture of linseed oil, cake, and meal in 1927 reported a total output valued at $111,234,271, of which amount $73,367,776 represents linseed oil; $32,073,890, linseed cake and meal; and $5,792,605, other products, consisting chiefly of oils other than linseed. The rate of decrease in the total value of products as compared with that for 1925, the last preceding census year was 20.8 per cent.

The statistics refer only to the output of those establishments which were engaged primarily in manufacturing or refining linseed oil for the trade, and do not, therefore, cover the value of such oil made and consumed by the same establishments in further processes of manufacture—for example, in the manufacture of paint and of linoleum. According to the returns from the Census Bureau's quarterly canvass of producers of animal and vegetable fats and oils, the total output of linseed oil during the calendar year 1927, including that made and consumed in the same establishments, amounted to 776,714,498 pounds, or 103,561,933 gallons. The corresponding total for 1925 was 763,882,379 pounds, or 101,842,983 gallons.

Of the thirty-two establishments reporting at the biennial canvass for 1927, seven were located in Minnesota, six in New York, five in Illinois, three each in New Jersey and Wisconsin, two each in California and Ohio, and the remaining four in Iowa, Kansas, Oregon and Pennsylvania. In 1925 the industry was represented by thirty-three establishments, the decrease to thirty-two in 1927 being due to the fact that one establishment was reported as idle during the entire year. The 1927 figures are preliminary and subject to such correction as may be found necessary after further examination of the returns.